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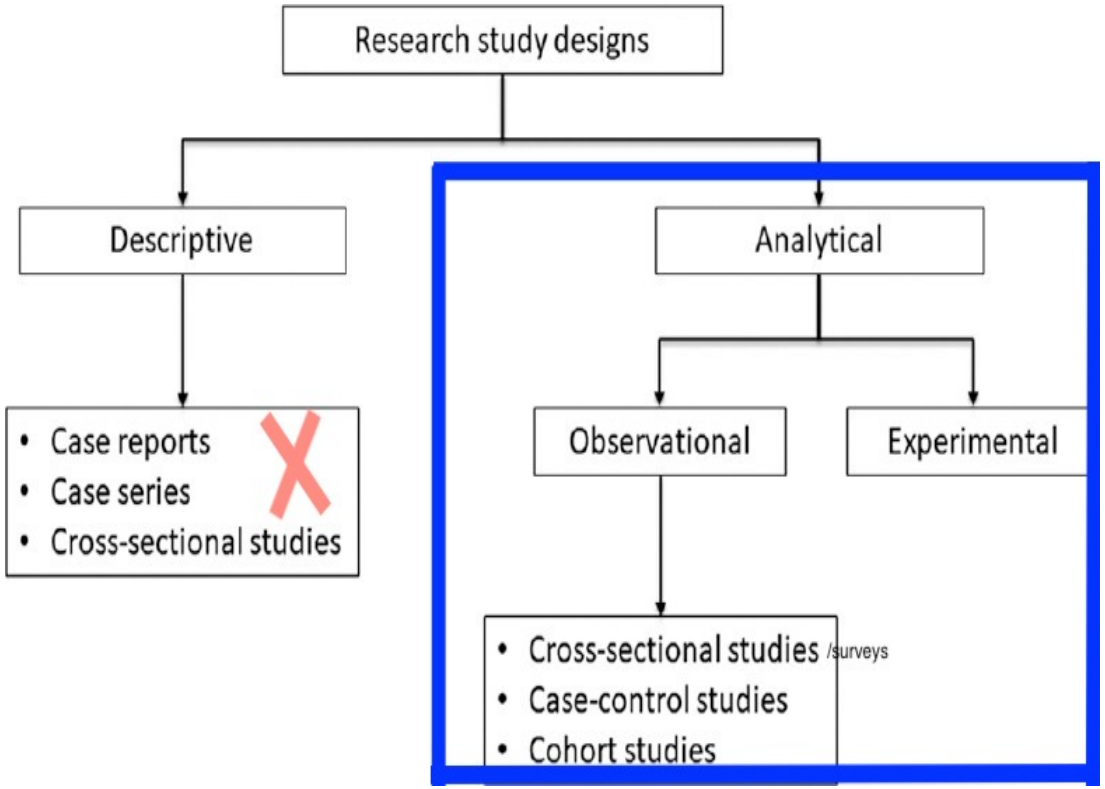
Biostatistics- 0504 252
Tutorial 2: Types of studies and sampling techniques

Type of studies

SURVEYS AND EXPERIMENTAL



Sampling Techniques

Some Notes

Population It is the entire group of individuals about which we want information.

Sample A part of the population from which we actually collect information. We use a sample to draw conclusions about the entire population.

Sampling Design A sampling design describes exactly how to choose a sample from the population.

Question 1 A faculty wants to know how university students feel about the Social Security system. She obtains a list of the 3456 undergraduates at her university and mails a questionnaire to 250 students selected **at random**. Only 104 questionnaires are returned.

- What is the population in this study?
- What is the sample?

Review

Some Notes

Bias The sampling design is biased if it systematically favors certain outcomes. It may occur when some part of the target population is not in the sampled population.

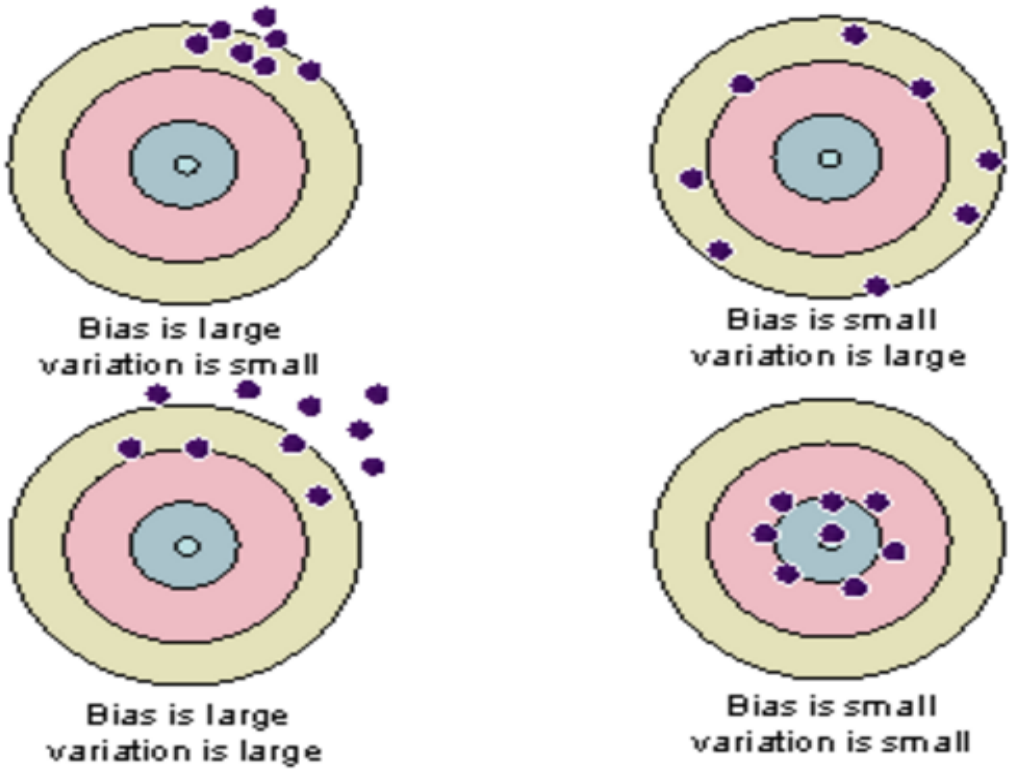
Example A sample of patients from public hospital. But people at private clinics tend to be more prosperous than typical Bangladeshis. In short, private clinics interviews will not contact a sample that is representative of the entire population.

Sampling Variability The fact of sampling variability is the value of a statistic varies in **repeated random sampling**. It is related to **precision**. Random samples eliminate bias from the act of choosing a sample, but they can still be wrong because of the variability that results when we choose at random.

Measurement Error It occurs when the response has a tendency to differ from the true value in one direction. For example, people sometimes do not tell the truth or they do not understand the questions.

Bias and Variability

Relationship between Bias and Variability



Bias and Variability

Describe your Bias and Variability...

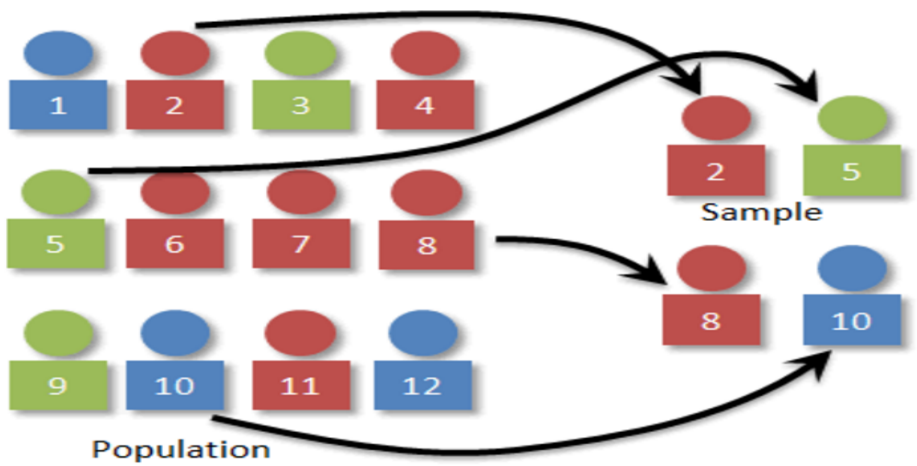
Sampling Techniques

Simple Random Sample

Definition

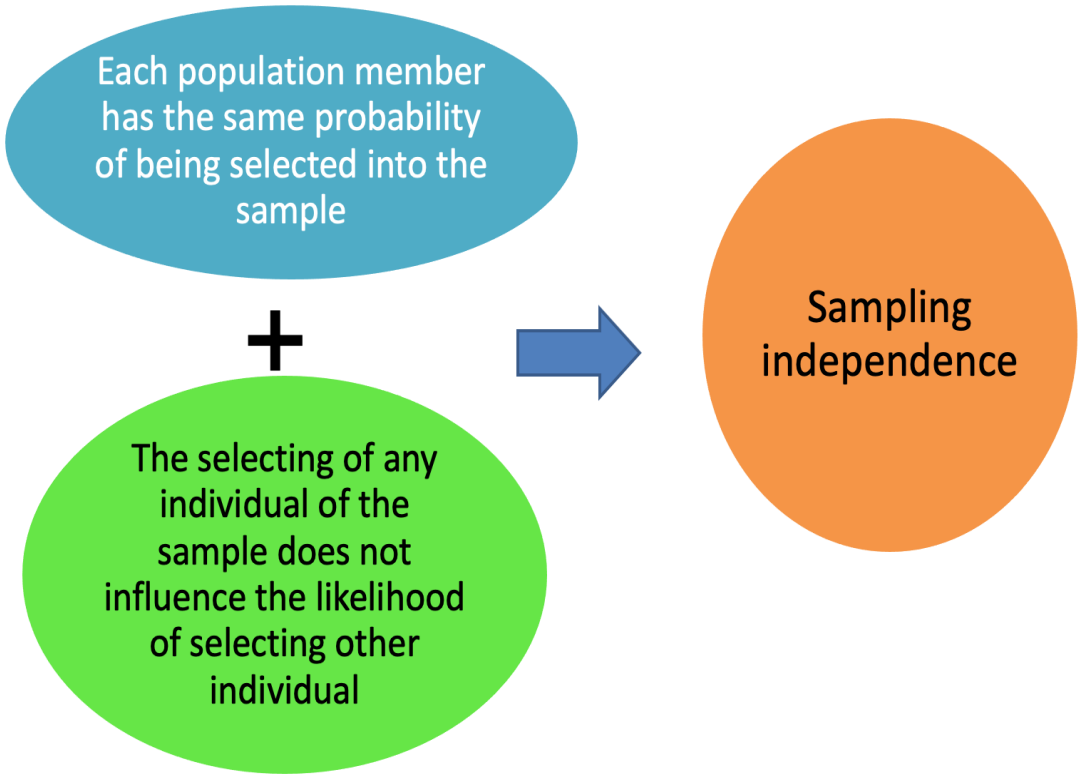
SRS A simple random sample (SRS) of size n consists of n individuals from the population chosen in such a way that every set of n individuals has an equal chance to be the sample actually selected.

Example A sample of mall shoppers is fast and cheap. But people at shopping malls tend to be more prosperous than typical Bangladeshis. They are also more likely to be teenagers or retired. Moreover, unless interviewers are carefully trained, they tend to question well-dressed, respectable people and avoid poorly dressed or tough-looking individuals. In short, mall interviews will not contact a sample that is representative of the entire population.



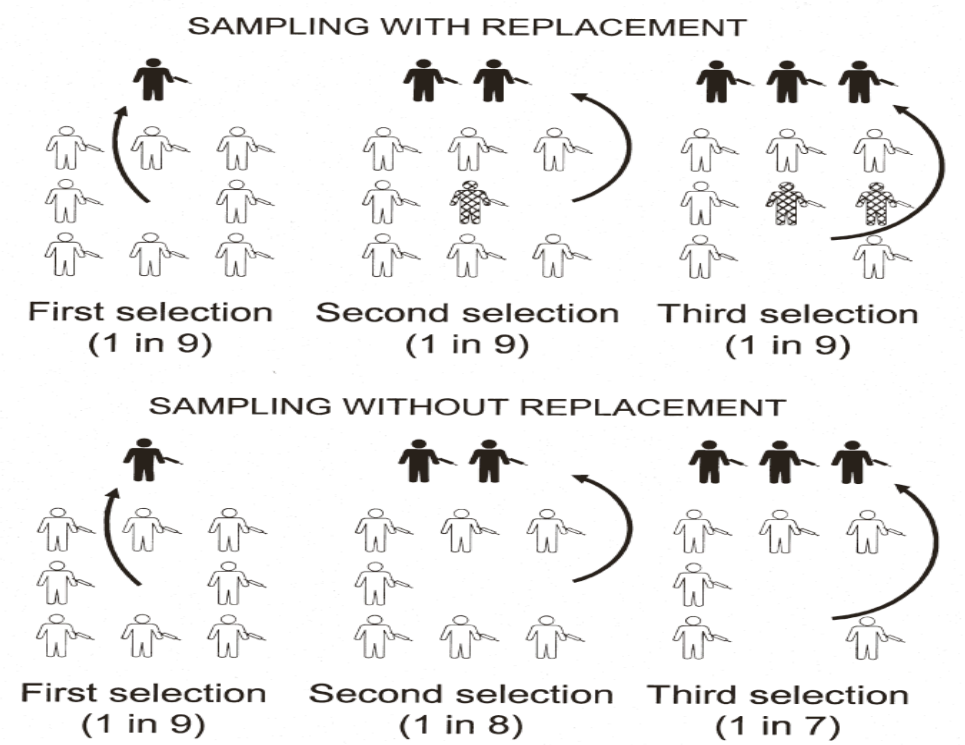
Simple Random Sample

SAMPLING INDEPENDENCE



Simple Random Sample

With and Without Replacement



Simple Random Sample

When not to use?

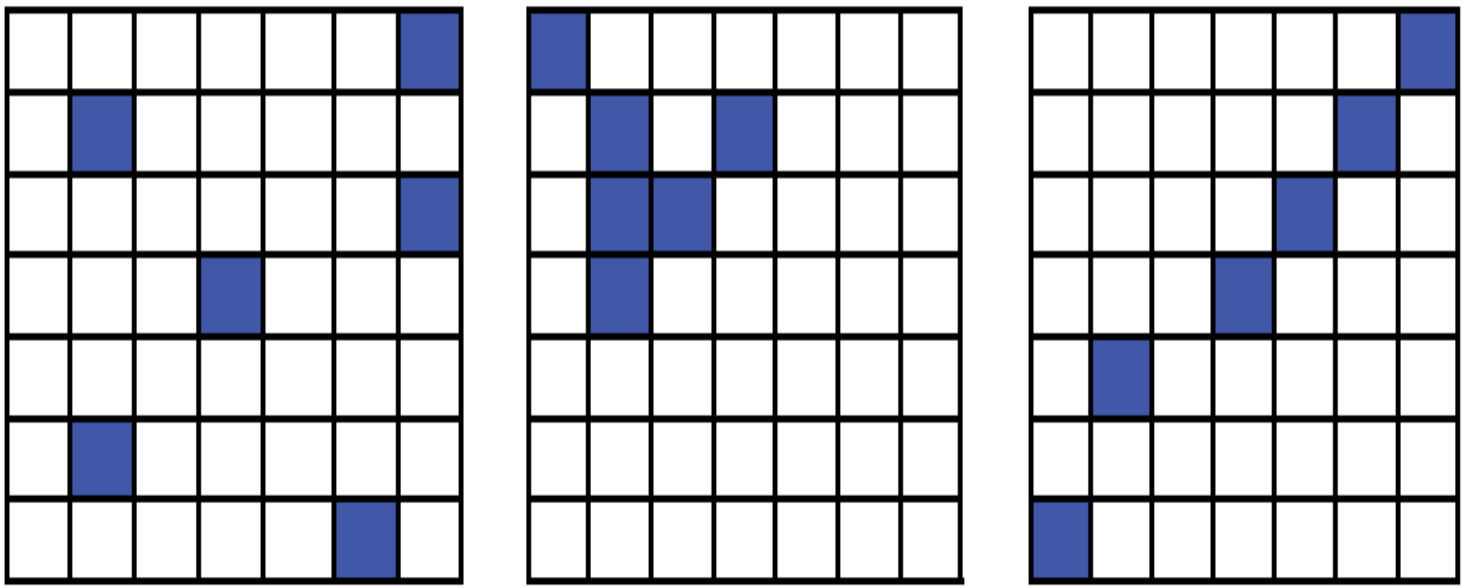
SRS though attractive for its simplicity, the design is not usually used in the sample survey in practice for several reasons:

- **Lack of listing frame:** the method requires that a list of population elements be available, which is not the case for many populations.
- **Problem of small area estimation or domain analysis:** For a small sample from a large population, all the areas may not have enough sample size for making small area estimation or for domain analysis by variables of interest.
- **Not cost effective:** SRS requires covering of whole population which may reside in a large geographic area; interviewing few samples spread sparsely over a large area would be very costly.

Sampling Techniques

QUESTIONS

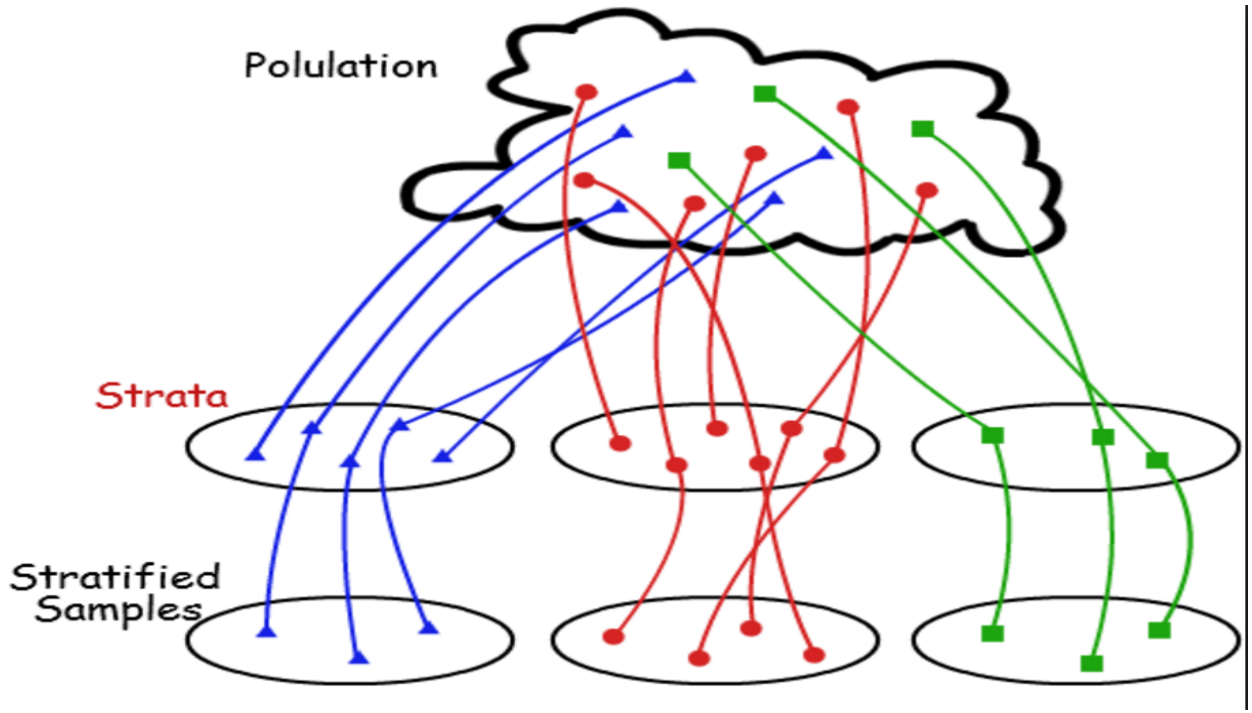
- Which is the most random?
- Is the most random one expensive?
- Is the most random one time consuming?



Stratified Random Sampling

Introduction

- Divide population into groups that differ in important ways.
- Basis for grouping must be known before sampling.
- Select random sample from within each group.



Stratified Random Sampling

Advantages and Disadvantages

Advantages :

- Useful when the population is heterogeneous and it is possible to establish strata which are reasonably homogeneous within each one.

N_1 units N_2 units N_3 units
n_1 units n_2 units n_3 units

- It improves the precision of estimates while keeping costs constant.
- To make the survey easier to administer operationally.

Disadvantages :

- May not always have the information you need on your frame so you know stratum sizes.
- May not know stratum st deviations or costs well to use optimal allocation.

Stratified Random Sampling

Sample Allocation Rules

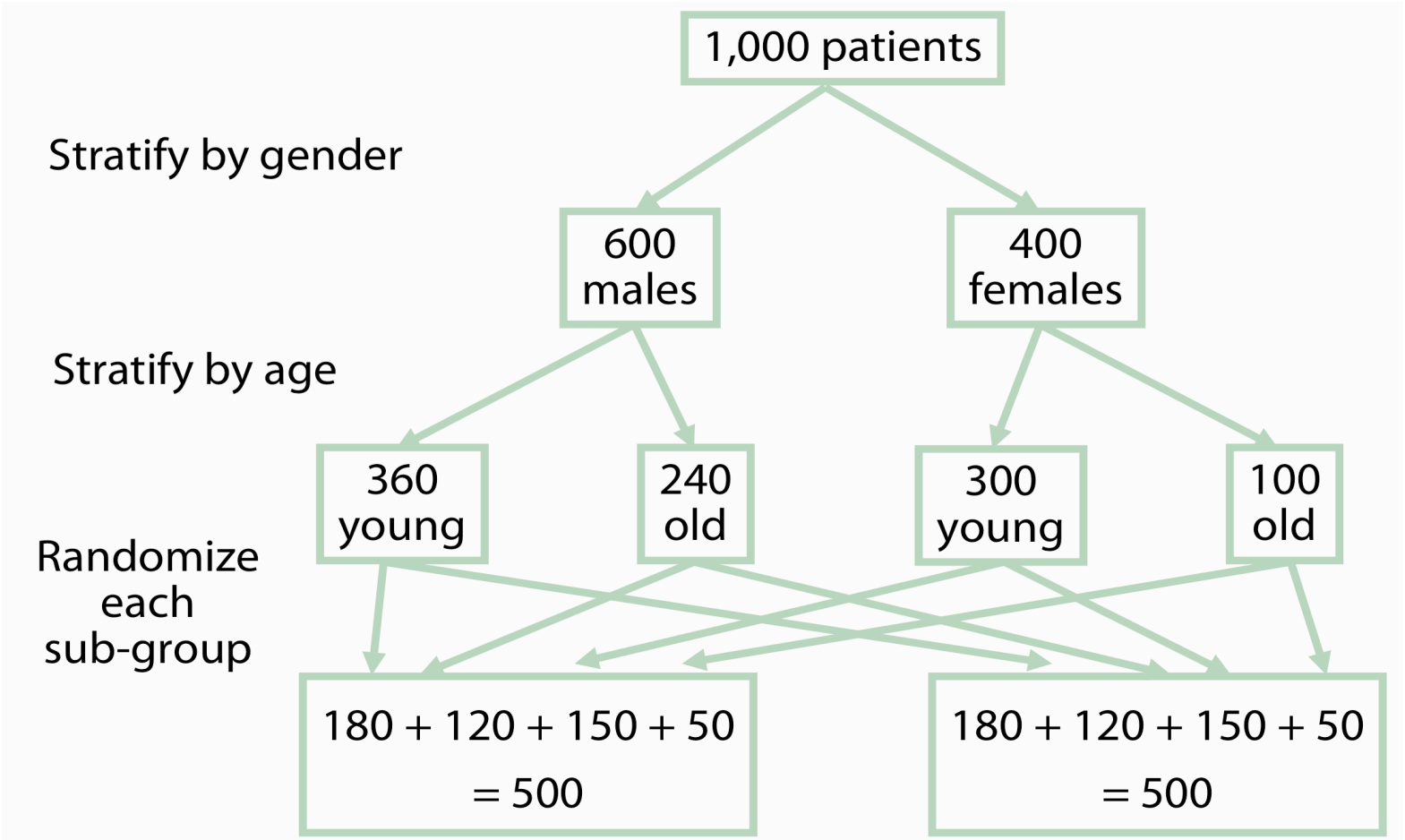
Equal Allocation: allocate the sample size equally in all the strata.

Proportional Allocation: allocate proportional to the size of the strata. **It is very widely used**.

Optimal Allocation: allocate proportional to size and stratum variances and inversely proportional to costs in the different strata.

Diagram of Stratified Randomization

Diagram



Systematic Sampling

Introduction

Defintion: Systematic sampling is a type of probability sampling method in which sample members from a larger population are selected according to a random starting point and a fixed periodic interval. This interval, called the sampling interval, is calculated by dividing the population size by the desired sample size.

Example: The researcher has a population total of 100 individuals and need 12 subjects. He first picks his starting number, 5.
Then the researcher picks his interval, 8. The members of his sample will be individuals 5, 13, 21, 29, 37, 45, 53, 61, 69, 77, 85, 93.

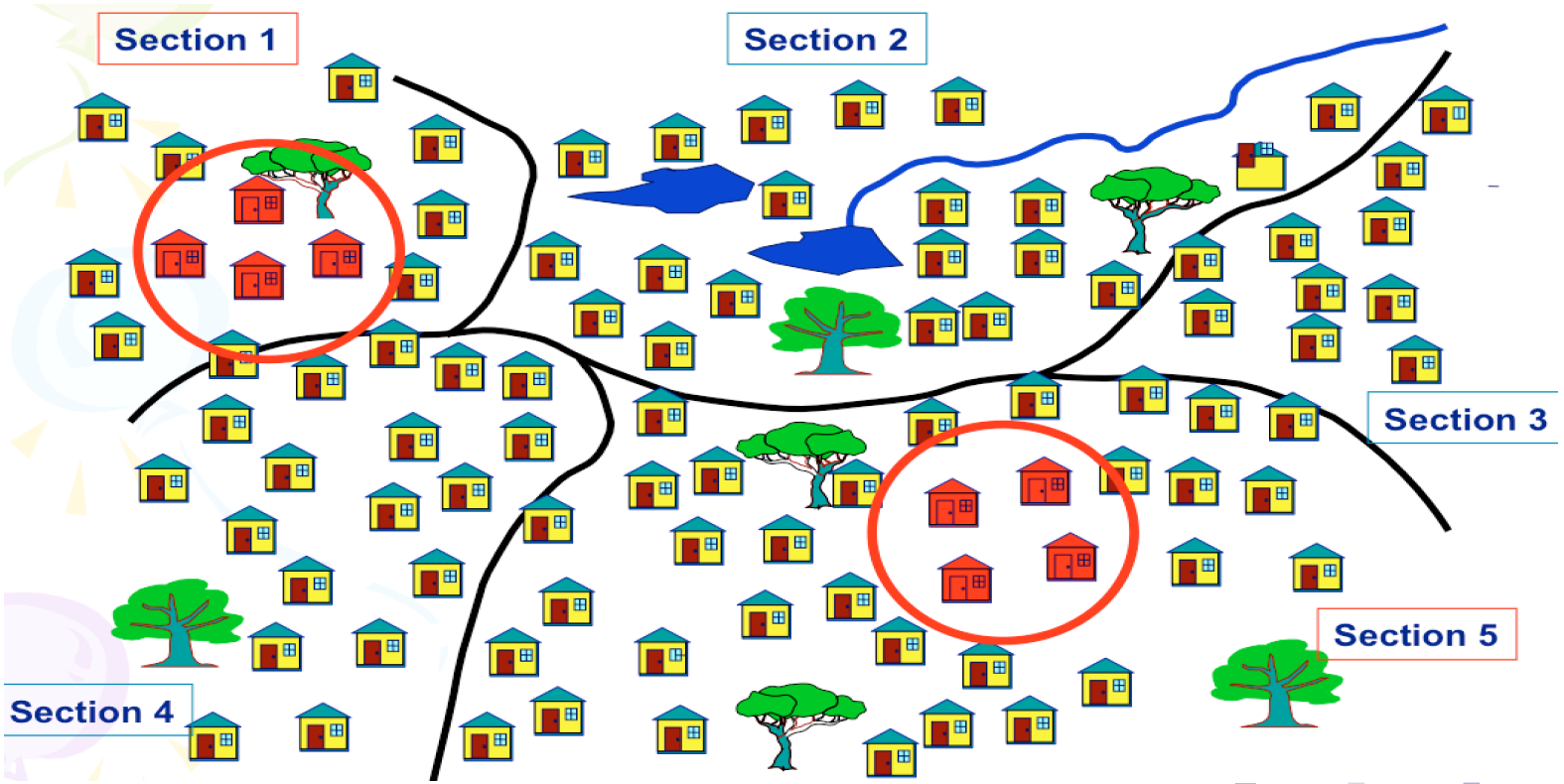
Advantages:

- The main advantage of using systematic sampling over simple random sampling is its simplicity. It allows the researcher to add a degree of system or process into the random selection of subjects.
- Another advantage of systematic random sampling over simple random sampling is the assurance that the population will be evenly sampled.

Cluster Sampling

CLUSTER

CLUSTER A group of sampling units close to each other i.e., crowding together in the same area or neighborhood.



Cluster Sampling

Introduction

- Population is divided into groups, usually geographic or organizational
- Some of the groups are randomly chosen
- In pure cluster sampling, a sampe of clusters is chosen and everyone is included in the survey.
- In simple multistage cluster, there is random sampling within each randomly chosen cluster.
- A commonly used two-stage cluster sampling scheme, the “30 x 7” sample, was developed by the WHO with the aim of calculating the prevalence of immunized children within +/- 10 percentage points. 30 x 7 means that you randomly select 30 blocks from all of the blocks in your county and then randomly select 7 interview sites per block.

Cluster Sampling

Advantages and Disadvantages

Advantages :

- Generating sampling frame for clusters is economical, and sampling frame is often readily available at cluster level
- Most economical form of sampling
- Larger sample for a similar fixed cost
- Less time for listing and implementation
- Also suitable for survey of institutions

Disadvantages :

- May not reflect the diversity of the community.
- Other elements in the same cluster may share similar characteristics.
- Provides less information per observation than an SRS of the same size.
- Standard errors of the estimates are high, compared to other sampling designs with same sample size

Sampling Techniques

Questions

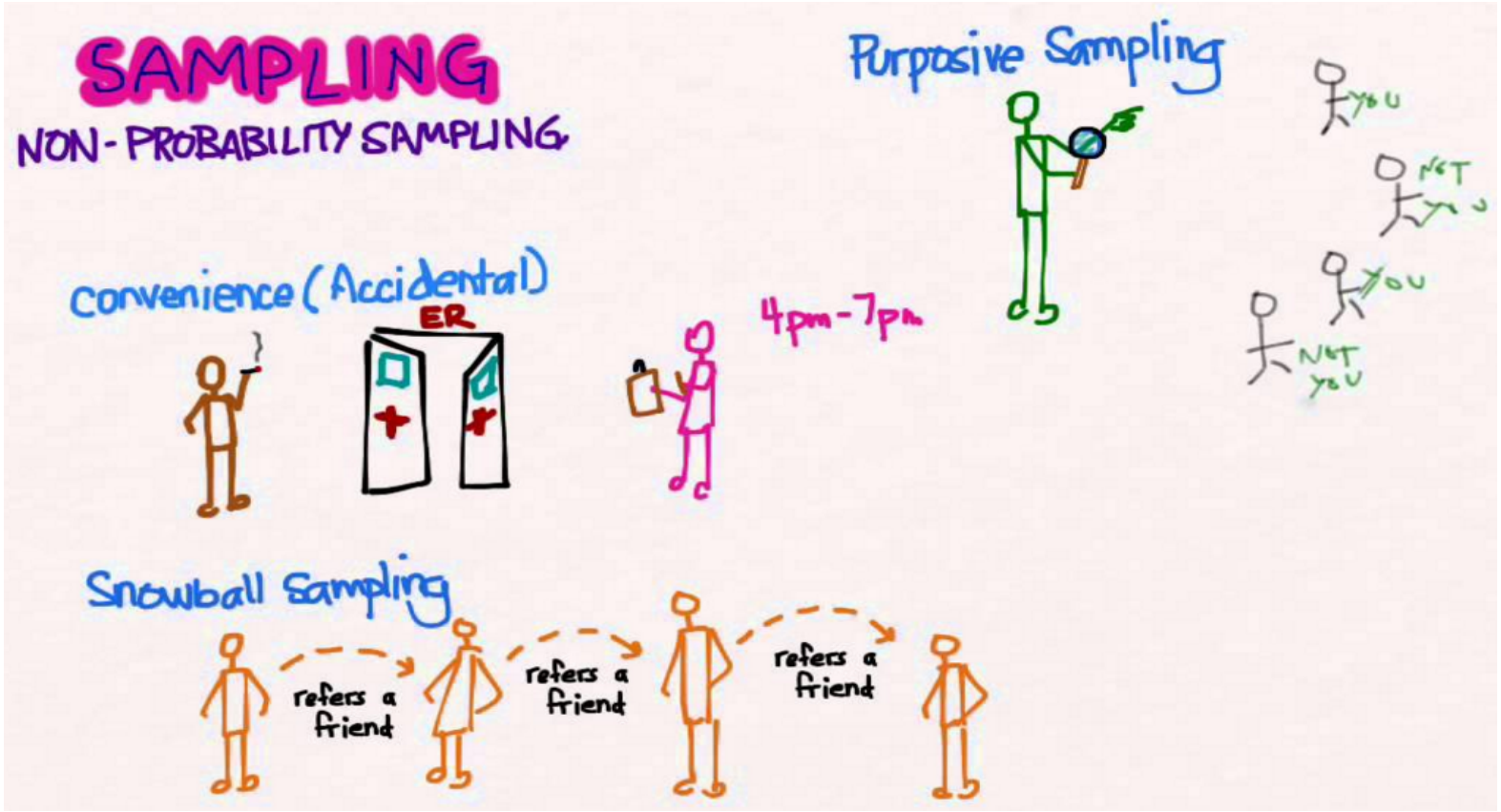
Discuss whether an SRS would be appropriate for the following situations.

- In a medical study, the population might be all adults over age 50 who have high blood pressure.
- For an e-mail survey of students, you have a sampling frame that contains a list of e-mail addresses for all students.
- In another study, the population might be all hospitals in the U.S. that perform heart bypass surgery.
- Choice of candidates in a election.
- Medication use for acute stroke among hospitals in Dhaka.

Sampling Techniques

Non-probability sampling

- Method in which the investigator himself collect or chooses the samples from the universe, which in his opinion are the best representatives of the population.
- Advantages: Simple, Flexible and Facilates purpose of the study
- Disadvantages: Biased, Not reliable and Inaccuarate.



Sampling Techniques

Summary of nonprobability sampling methods

Convenience sampling Participants are selected based on availability and willingness to take part

Purposive sampling Also known as judgmental or subjective sampling. It relies on the judgment of the researcher when choosing members of the population to participate in a study

Snowball sampling Existing study subjects recruit future subjects from among their acquaintances